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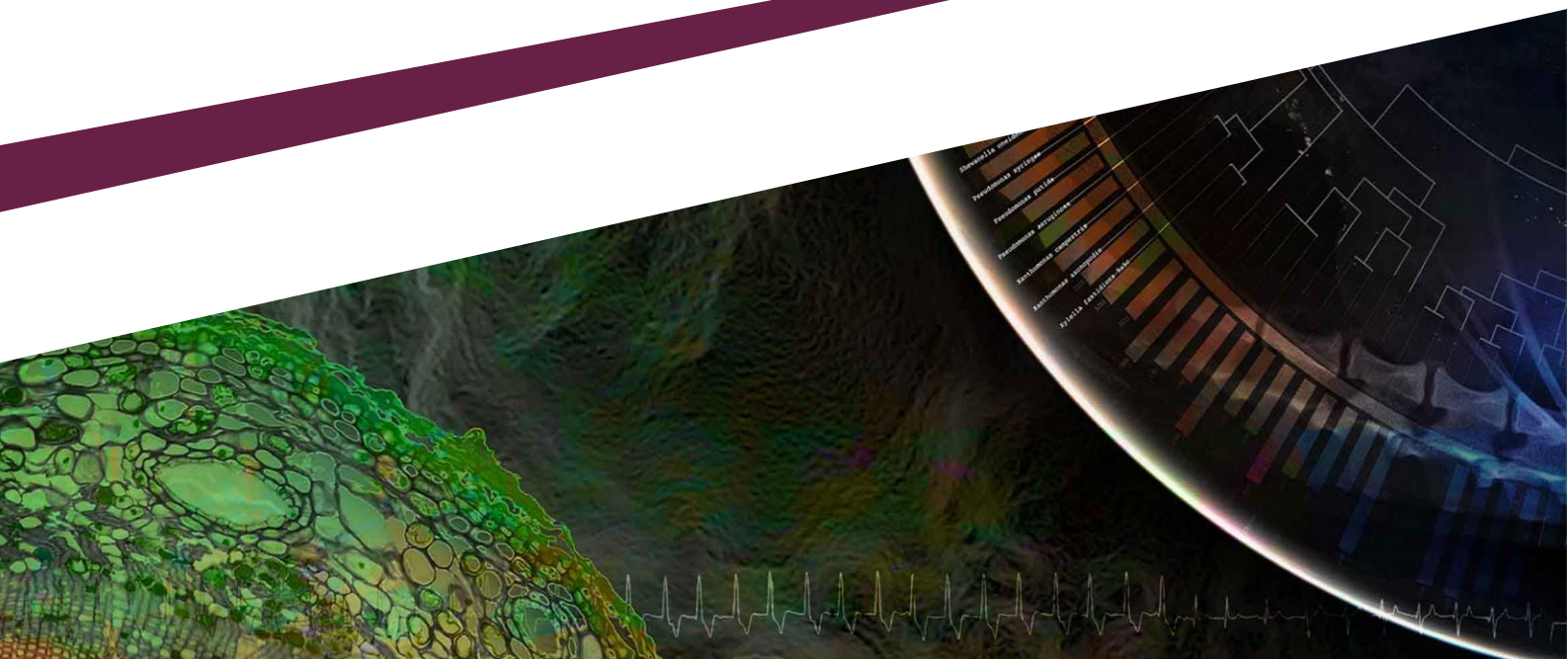

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Preface

This report presents the results of a study funded by the SLU Forest Damage Centre at the Swedish University of Agricultural Sciences (SLU). The funder had no role in the design of the study or in the data collection and analysis of the data, nor in the decision to publish the results. The author thus takes full responsibility for the content of the report.

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Abstract

Forest damage caused by insects, fungi, animals or other pests is a global problem and is expected to become even more common in the future due to a warmer climate and increased international trade. In Sweden, approximately 10% of the forest is estimated to have some form of damage. For the individual forest owner, forest damage can lead to large costs and lost forest values, not only financial. However, previous studies have shown that many forest owners lack knowledge of the state of damage in their forest and that many have limited knowledge of how forest damage can be managed and prevented. Many forest owners may therefore be in need of professional advice and services in this area. The aim of this study was therefore to elucidate the advice and services that forest companies today offer to individual forest owners regarding the management and prevention of forest damage. The study also highlights the forest companies' current approach towards some of the management alternatives that have previously been highlighted as ways to prevent damage.

Data on what advice and services that the forest companies provide to the forest owners was collected through eleven semi-structured interviews with representatives from eight different forest companies. Most of the interviewees worked as timber buyers. These were chosen because they often manage the contacts with the forest owners when it comes to advice and forestry services. In order to describe what information about forest damage the companies convey to the forest owners via their customer or member magazines, the content of magazines from three forest companies and three forest owners' associations was examined.

The results show that the forest companies generally offer the forest owners the same types of services and most of the participating companies were full-service organizations that offer the forest owners all types of forestry measures. According to the interviewed timber buyers, the general advice to the forest owners regarding damage minimization was to choose the right tree species for the land when rejuvenating, to carry out forestry activities at the right time and to be active and visit their forest regularly. According to the timber buyers, the focus on site adaptation had increased in recent years. When it came to specific advice for forest owners who were affected by forest damage, they depended to a large extent on the damage situation and the age of the forest, but also the type of forest owner it concerned. This means that the timber buyers can give different types of advice to self-employed forest owners who have the prerequisites to take care of damaged trees themselves than what they can give to other forest owners. The alternatives when a forest suffered damage were often stated to be limited, and the advice was often about how the damaged forest or trees could be felled and removed in the best way.

The advice on preventive actions was to a large extent linked to the forest's rejuvenation phase. A number of respondents had noted an increased interest from the forest owners in planting larch and an increased interest in continuous cover forestry. In their advice, however, the timber buyers still emphasize traditional indigenous tree species and rotation forestry, even though some companies are adapting their service offering to meet forest owners' demand for continuous cover forestry. It also emerged that the forest certification rules can have a limiting effect on what advice the timber buyers can give, e.g. regarding the use of non-native tree species. A conclusion from the study is that the forest companies' advice and services focus on timber production and primarily benefit active forest owners. Other forest owner groups that do not actively contact the forest companies may therefore need to be reached in other ways with information and support regarding forest damage.

Keywords: family forest owners, forest consultancy, forestry, timber buyer, forest damage

Sammanfattning

Skogsskador orsakade av insekter, svampar, djur eller andra skadegörare är ett globalt problem och förväntas bli än mer vanligt förekommande i framtiden på grund av ett varmare klimat och ökad internationell handel. I Sverige beräknas ungefär 10% av skogen ha någon form av skada. För den enskilde skogsägaren kan skogsskador innebär stora kostnader och förlorade skogliga värden, inte enbart ekonomiska. Tidigare studier har dock visat att många skogsägare saknar kännedom om skadeläget i sin skog och att många har begränsade kunskaper om hur skogsskador kan hanteras och förebyggas. Många skogsägare kan således vara i behov av professionella råd och tjänster inom detta område. Den här studiens syfte var därför att kartlägga vilka råd och tjänster som skogsföretagen idag erbjuder till enskilda skogsägare angående hantering och förebyggande av skogsskador. Studien belyser också skogsföretagens nuvarande inställning till några av de skötselalternativ som tidigare har lyfts fram som sätt att förebygga skador.

Information om vilka råd och tjänster som skogsföretagen ger till skogsägarna samlades in genom elva semi-strukturerade intervjuer med representanter från åtta olika skogsföretag. Merparten av intervjupersonerna arbetade som virkesköpare. Dessa valdes eftersom de ofta sköter kontakterna med skogsägarna när det handlar om rådgivning och skogliga tjänster. För att beskriva vilken information om skogsskador som företagen förmedlar till skogsägarna via sina kund- eller medlemstidningar undersöktes innehållet i tidningar från tre skogsbolag och tre skogsägarföreningar.

Resultaten visar att skogsföretagen generellt erbjuder skogsägarna samma typer av tjänster och de flesta medverkande företagen var fullservice organisationer som erbjuder skogsägarna alla typer av skogliga åtgärder. De generella råden till skogsägarna när det gäller skademinimiering var enligt de intervjuade virkesköparna att välja rätt trädslag för marken vid föryngring, att utföra skötselåtgärder vid rätt tidpunkt samt att vara aktiv och besöka sin skog regelbundet. Enligt virkesköparna hade fokuset på ståndortsanpassning ökat under senare år. När det gällde specifika råd till skogsägare som drabbats av skogsskador så är de i hög grad beroende på skadesituationen och skogens ålder, men även vilken typ av skogsägare det gällde. Med detta menas att virkesköparna kan ge andra typer av råd till självverksamma skogsägare som har förutsättningar att själva ta hand om skadade träd än vad de kan ge till andra skogsägare. Alternativen när en skog har drabbats av skador uppgavs ofta vara begränsade och ofta handlade rådgivningen då om hur den skadade skogen eller de skadade träden kunde avverkas på bästa sätt.

Rådgivningen kring förebyggande insatser var i hög utsträckning kopplad till skogens föryngringsfas. Ett flertal respondenter hade noterat ett ökat intresse från skogsägarna för att plantera lärk samt ett ökat intresse för hyggesfritt skogsbruk. I sin rådgivning framhäver dock virkesköparna fortfarande traditionella inhemska trädslag och trakthyggesbruk, även om vissa företag håller på att anpassa sitt tjänsteutbud för att möta skogsägarnas efterfrågan gällande hyggesfritt skogsbruk. Det framkom också att skogscertifieringsreglerna kan ha en begränsande effekt på vilka råd virkesköparna kan ge, t.ex. när det gäller användningen av främmande trädslag. En slutsats från studien är att skogsföretagens råd och tjänster fokuserar på virkesproduktion och kommer främst aktiva skogsägare till del. Andra skogsägargrupper som inte självmant tar kontakt med skogsföretagen kan därför behöva nås på andra vis med information och stöd kring skogsskador.

Nyckelord: privata skogsägare, skoglig rådgivning, skogsbruk, virkesköpare, skogsskador

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1. Introduction

In Europe, there are approximately 228 million hectares (ha) of forest, of which 67% are forests available for wood supply, with a larger proportion located in the northern and central parts of the continent (Egger et al. 2024). In the north, conifers such as spruce and pine dominate the forest landscape, while in other regions it is more evenly distributed between coniferous and broadleaved tree species (Forest Europe 2020). Because of its abundance, the forest is an important resource that provides many people with work, essential renewable products for everyday life, and important ecosystem services and social goods in the form of recreational opportunities and access to non-wood products such as berries, mushrooms, and game. In Europe alone, the forest sector employs some 3.5 million people and the direct economic contribution of the forest sector to the gross domestic product is estimated to be USD 185 billion and more than twice as large if indirect and induced effects on value added are also taken into account (FAO 2022). For several reasons, it is therefore worrying that the general state of health of the forest has deteriorated. According to available statistics, there is forest damage in just over 3% of Europe's forests, but some countries are significantly more affected than others (Forest Europe 2020).

Forest damage is a global problem that annually causes large costs, not only financially but also in the form of lost biodiversity and impact on various ecosystem services. In addition to damage directly caused by human activity, the forest is increasingly exposed to damage linked to a changing climate and increased international trade, which contributes to the spread of various biological pests (Ramsfield 2016). Indeed, a warmer climate can be beneficial for forest growth due to an extended growing season. However, the positive effect is counteracted or even outweighed by the fact that it also increases the risk of the forest suffering damage from e.g. insects and other biological pests that also thrives in warmer climates (Lindner et al. 2010). Furthermore, extreme events such as fire, drought, storms and floods may become more frequent in the future, further increasing the risk of damage as this leads to the trees becoming more susceptible to attack by pests (Boyd et al. 2013; Seidl et al. 2017; FAO 2022). According to Seidl et al. (2017), natural disturbances resulting from changes in climate are likely to be most noticeable in coniferous forests and the boreal biome. Here, there may be changes in the distribution of tree species, e.g. with greater coverage of hardwoods further

north, and pests that previously did not survive severe northern winters are more likely to survive and spread over larger areas as temperatures rise. Various fungal diseases also benefit from this. In addition, higher winter temperatures can make logging more difficult due to wet soils, increasing the risk of rutting (Lindner et al. 2010).

A country where forest damage has been common in recent years, especially in comparison to many other countries in Europe, is Sweden where nearly 10% of the forest has some type of damage (Forest Europe 2020). This is a significant area because Sweden, with 27.9 million ha of forestland, is one of the most forested countries in Europe (Roberge et al. 2024; Eurostat 2024). The country's forests have been particularly exposed to bark beetle attacks and grazing damage from moose and other ungulates. During the period 2018-2023, bark beetles killed 34 million cubic meters of forest (Swedish Forest Agency 2024a), which can be put in relation to the fact that the annual felling is about 90 million cubic metres (Roberge et al. 2024). Regarding grazing damage, the latest figures show that on average 11% of the pine trees in the young forest (1–4 meters high) are annually affected by grazing damage, which is more than twice as high compared to the national target of a maximum of five percent (Swedish Forest Agency 2024a). In addition to insects and ungulates, fungal diseases have also been a concern for Swedish forest owners, especially in the northern parts of the country. An example of such a commonly occurring forest damage is pine stem rust caused by the fungi *Cronartium flaccidum* and *Peridermium pini*. It is also common for several different types of damage to occur at the same time, which leads to so-called multi-damaged forests (Normark 2019; Wulff et al. 2022).

The high level of damage means that extensive and multifaceted actions are required to reduce the damage. The Swedish Forestry Agency recommends, among other things, to have the right type of tree on the right land, clear and thin at the right time and to the right density, increase the proportion of deciduous trees, be careful when planting, and identify and remove infested and/or storm-felled trees in time (Swedish Forest Agency 2024a). Here, a large responsibility falls on the individual forest owners, who are ultimately the ones who must decide on and carry out the forest management activities. Either by themselves or with the help of professional service providers. Since half of the forest in Sweden is owned by about 310,000 non-industrial private forest (NIPF) owners who on average have a forest property of 34 ha and a median property of 11 ha, these are generally small-scale owners (Swedish Forest Agency 2024b). Hereafter, the term forest owners refer to NIPF owners unless otherwise stated.

For the individual forest owner, therefore, a local storm, fire or outbreak of forest damage caused by animals, insects, fungi or other biological pests can quickly affect a relatively large part of the forest holding. However, the large number of forest owners also means that the knowledge and interest in the forest, as well as

their forest values and goals, vary greatly within this group (Eriksson and Fries 2020; Eriksson and Fries 2021), and thus also individual owners' preconditions and incentives to manage the forest in a certain way. Regarding forest damage, a study by Kronholm (2024) has shown that one in five forest owners lacks knowledge of the state of damage in their own forest, and that forest owners generally feel they lack the knowledge to be able to identify several of the most common forest damages in the area themselves. The only type of damage that most of the forest owners believed they could identify was moose grazing damage. Moreover, many forest owners were unsure about how to prevent and take care of forest damage. This is problematic because it can lead to any damage having time to spread to larger areas before they are taken care of. Finally, a large proportion of forest owners were found to have a negative attitude towards some of the management alternatives that have been proposed as measures to counteract forest damage, which of course can affect how well the damage minimization succeeds.

Forest owners' limited knowledge of forest damage means that many may need the support of professional advisers and service providers for their forest management. Indeed, the forest owners' service needs have increased in several areas and forest companies have responded by adapting their service offers to meet the demand (Kronholm 2016; Andersson & Keskitalo 2019). Today, most of the felling work is already outsourced by the forest owners, but over time the proportion of other types of forest management activities that the forest owners carry out themselves has also decreased. Of the total amount of work in forestry, forest owners perform just under 40% of the hours worked (Roberge 2018). The most common management activities for forest owners to carry out themselves are planting and pre-commercial thinning (Lidestav & Westin 2023). From the forestry industry's perspective, there should be an interest in supporting the forest owners because they are important suppliers of raw materials and the presence of forest damage can affect their harvesting intentions, the quality of the timber and the timber market as a whole (Angelstam et al. 2000; Prestemon & Holmes 2008; Markowski-Lindsay et al. 2020). In recent years, the forest owners' share of the annual total felling volume has been approximately 60%, corresponding to nearly 60 million cubic meters of wood (Roberge et al. 2024).

Previous studies have shown that a majority of forest owners appreciate advice from professionals when making decisions about their forest management and that many also largely leave the decisions to them. This applies especially to those forest owners who live further from their forest, have a job, and/or are women (Hujala et al. 2009). Partly, this is linked to the forest owner's inexperience with forestry, where the inexperienced rely more on professional recommendations and services, but even experienced owners can often delegate parts of the decision through dialogue. Forest owners with strong opinions who are not prepared to change their minds based on information from professionals make up a relatively small

percentage of forest owners (Hujala et al. 2007; Hujala et al. 2009). A common way to support the forest owners is to provide them with a forest management plan, which can be the basis for decisions over the next 10 years or more. Currently, approximately half of the forest owners in Sweden have an up-to-date forest management plan (Lidestav & Westin 2023; Kronholm 2024). Providing forest owners with a written forestry plan is of interest to several parties as it has been shown to increase their willingness to counteract forest damage (Molnar et al. 2007). Historically, however, there has been little focus on active risk management in Swedish forestry (Blennow 2008), which makes it uncertain to what degree today's forestry plans are adapted to minimize damage risks. In fact, none of the forest owners interviewed by Uggla and Lidskog (2016) had discussed with forestry advisers how they could adapt their forestry to better counter the expected effects of climate change.

In light of the above, the aim of this study was to elucidate what advice and services forest owners currently receive from forest companies' professional advisors regarding the management and prevention of forest damage. Through semi-structured interviews with company officials, any differences between the companies regarding their view of forest damage and what needs to be done to alleviate the damage situation in the future could also be identified.

2. Materials and methods

2.1 Interviews

The empirical data for this study were collected in May and June 2024 through semi-structured interviews with representatives of Swedish forest companies and forest owner associations. A criterion-based selection strategy was applied in the selection of respondents to ensure that the respondents would be able to provide useful information as well as to find as great a variety of experiences and perspectives as possible within a limited sample (Richie & Lewis 2003). Firstly, the relevant forest companies would have forestry services aimed at forest owners. Secondly, it was considered important to choose companies in different geographies because this can affect the type of forest damage that dominates in the area and the conditions for forestry differ between north and south. Thirdly, the interviewee should have good knowledge of what advice and services are currently offered to forest owners. The category of employees who were judged to have this insight were primarily timber buyers and corresponding functions. Because even if their job title is timber buyer, they also function as advisors and sellers of various services and it is these individuals who are most often in direct contact with the forest owners.

Based on the above criteria, contact information for potential interviewees was collected from the forest companies' websites. The selected companies were large, well-known forestry companies that all depend to a greater or lesser extent on timber deliveries from forest owners and thus have activities directed at this group. Among the selected companies, there were both those that had their own industry (sawmills, pulp mills, etc.) and those that did not. Furthermore, there were companies that had their own forest in addition to the timber purchase business and those who only got timber through purchase from forest owners. Finally, both forest owner associations and ordinary forest companies were included.

Potential interviewees were contacted by e-mail where the background and objectives of the study were presented together with a question if they would be willing to be interviewed on this topic. They were also informed that the identities of the interviewees would not appear in published material. As several of the companies had a large number of employees who matched the selection criteria, the

choice of which of them to contact was made arbitrarily but taking into account the geographical regions in which they worked. In addition, both men and women were actively included among those contacted, although this was not a designated selection criterion in this study. Invitations were sent out continuously until it was judged that further interviews would not contribute new information of significant value to the study. The final sample consisted of eleven respondents representing eight different organizations. A total of 68 individuals were contacted, which means that approximately one out of six persons contacted agreed to an interview.

The interviews were conducted in the form of video meetings via Microsoft Teams. With participants' consent, audio, but not video, was recorded with a digital voice recorder. The interviews lasted between 30 and 60 minutes, with an average of approximately 40 minutes. The interviews were semi-structured and therefore followed the same set-up, with minor variations depending on the respondent's answers in order to have a good flow in the conversation. Initially, the respondents were asked to describe how they experience the forest damage situation in their work area and what kind of damages that are common. Questions were then asked, among other things, about what advice they give to forest owners who contact them regarding forest damage. During the interview, the participants were also shown some results from a previous study that examined forest owners' attitudes to different management alternatives that can prevent forest damage and the respondents were asked to describe whether and how they currently apply these. The interviewer (author) later transcribed the interviews. The transcriptions focused on the content of the interviews, which means that e.g. the tonality of the respondent, repetitions, pauses, etc. was not given any special attention in the transcripts. The interview material was then analyzed in terms of content by comparing the respondents' answers and looking for similarities and differences in relation to the themes that were discussed during the interviews. The results have been presented under these themes and all citations have been translated from Swedish to English by the author as carefully as possible to retain their original meaning.

2.2 Review of magazines

In Sweden, it is quite common for forest companies to have member/customer magazines that they send to forest owners. Therefore, in addition to investigating what information the forest owners receive from the timber buyers, what information the companies convey about forest damage via their magazines was also investigated. The selection of examined magazines was based partly on the basis of availability and partly on reach, i.e. they were published by larger companies and forest owner associations. The sample examined consisted of six magazines, three from forest owner associations and three from large forest

companies. The reviewed period extended from the beginning of 2022 to the first half of 2024 and since most of the magazines were published four times a year, in one case twice a year, this means that at most 10 issues per magazine were reviewed.

The relevance of the journal articles was initially assessed based on the title and preamble, and then the entire article was read if it was judged to be relevant for the topic of this study. In addition to articles that directly mentioned forest damage, some that were indirectly linked to this are also included, e.g. by dealing with how climate change affects forestry and the risk of damage. The collected material was then analyzed both quantitatively (how often this type of article is published) and qualitatively (which topics were included).

3. Results

3.1 Forest damage situation according to timber buyers

Most timber buyers described the forest damage situation in their working area to be troublesome (Table 1). One of the timber buyers in the south estimated that every second forest owner in the area had suffered from some sort of damage, to varying extents. A timber buyer working in the northernmost part of the country said that about 25% of the forest owners who make contact mention forest damage. Several timber buyers brought up the year 2018 as a starting point when describing today's situation. This because it was an exceptionally tough year (with a very dry summer) that also came to affect damage levels in several subsequent years.

There was a geographical difference regarding the prevalence of different types of damages (Table 1). Timber buyers in the north more often pointed out pine stem rust as a significant problem compared to timber buyers working further south. Furthermore, timber buyers in the south had to a greater extent had to deal with forest damage caused by bark beetles than those working in the northern parts of the country. Forest damage caused by moose and other ungulates such as deer were common all over the country. However, from the interviews it was also clear that there are significant local variations between regions and between districts.

Table 1. The respondents' view of the damage situation in the area in which they work. Northern Sweden refers to counties in Norrland, Central Sweden refers to counties in Svealand, and Southern Sweden refers to counties in Götaland.

Respondent	Location	Forest Damage Situation
A	Northern Sweden	The main problem is moose grazing damage, which was stated to be really extensive in some places. In certain areas, pine stem rust was also said to be a problem.
B	Southern Sweden	In previous years, bark beetles have been a major problem but the situation is a somewhat better now as much of the damaged forest has been cut down. An increasing problem are pine weevils that attack seedlings.
C	Central Sweden	The situation was described as having been catastrophic due to the bark beetle, although it has eased somewhat in the past year. There is also a lot of grazing damage from moose.
D	Central Sweden	Mainly bark beetle, with a peak in the 2021/2022 season. Locally, however, there are still heavily affected areas.
E	Central Sweden	The damage situation was described as problematic, mainly because of the bark beetle. There is also a lot of damage from red deer in the spruce forests as well as root rot on spruce.
F	Central Sweden	In some areas, there is a lot of moose grazing damage. Trees with drought damage have increased in recent years, probably due to spruce bark beetle.
G	Southern Sweden	Less problems with the bark beetle than districts further east. The most frequent cause of damage is moose and other ungulates.
H	Northern Sweden	The damage situation was described as problematic, but it differs between regions (within the company). Lately, there has been a lot of focus on pine stem rust and snow breaks (i.e. the top of the tree breaks due to heavy snow).
I	Northern Sweden	The damage situation was described as mixed, since the damage can often be concentrated in certain local areas. A lot of moose grazing damage and some pine stem rust.
J	Northern Sweden	The area was described as having major problems with forest damage. Pine stem rust is the biggest problem. The moose is a problem in some places.
K	Northern Sweden	Quite a lot of damage. Above all, pine stem rust is present to a large extent, but also moose grazing damage. There are also some snow breaks.

3.2 Offer of services

Regardless of the type of company or in which part of the country, they all had roughly the same basic range of services. In most cases this meant being full-service organizations offering all types of forestry services. The only thing that some of them lacked was financial services such as help with tax returns and similar services. When asked if they have any services linked to forest damage, one of the respondents answered that “Actually, we do not have special services specifically for forest damage, but it will be like general advice in a way”. This applied to most of the companies, although some had services that could also be used for cases involving forest damage. For example, some of them had mobile phone apps where the forest owner could manage their business, and in some cases also report forest damage on their property. However, a timber buyer stated that it is more common for forest owners to call if they have problems than to report via the app. For the timber buyers, it was therefore mainly about using the toolbox of services and knowledge they had to solve the forest owners' problems on a case-by-case basis.

3.3 Timber buyers' advice when damage has occurred

When a damage has occurred, there is often a dialogue between the timber buyer and the forest owner about what actions can be taken. Which alternatives are available depends partly on the type of damage, the characteristics of the forest and the forest owner's own skills, needs and objectives. As a result, it was difficult for the timber buyers to give concrete answers about how they do it or what advice they give when a forest owner contacts them after their forest has been damaged. Despite this, it was possible to discern certain similarities between how timber buyers deal with different types of damage.

3.3.1 Bark beetle

When it comes to spruce bark beetle attacks, the timber buyers highlighted the importance of acting quickly. However, for this type of damage there are often few alternative to consider. Since it is difficult to stop the bark beetle once it has attacked the forest, according to a timber buyer, it is often the case that the forest has to be cut down. This is especially the case when it comes to mature spruce forests. One timber buyer described the process in the following way:

> In the event of an attack by the spruce bark beetle, and it is of a certain extent, it is important to get machines there as soon as possible and cut down and remove the wood as quickly as possible to influence the population in the right direction. That's what you can do when it comes to the spruce bark beetle.

Helping the forest owners to obtain felling resources quickly was something several timber buyers mentioned when bark beetle damage was discussed. For example, one of them highlighted how the company had moved machine and planning resources between regions to help each other when there has been a crisis. The respondent also described how this type of action could require a certain amount of creativity in the management of machine groups and that contractors are willing to accept the special circumstances. However, another timber buyer also described how stressful the situation can be for them when many forest owners are affected at once and everyone wants their forest to be prioritized.

The connection between the wind-throws and spruce bark beetle attack was also brought up in connection with this, and it is also important to get rid of these quickly. Then it may not always be rational to bring in large machines, but the timber buyers can alert the forest owners about the damage and in some cases be helpful in obtaining manual felling resources if the forest owner cannot take care of the fallen trees themselves. In some cases, one timber buyer had also tried to help the forest owners to debark trees, but according to the timber buyer, there were few contractors willing to carry out such work and it would also be expensive for the forest owner. In the cases where a smaller number of trees are to be removed, the forest owner's own ability to carry out the work therefore plays a role in the type of service or advice offered.

3.3.2 Pine stem rust

The timber buyers' advice to forest owners whose forest had been damaged by pine stem rust varied depending on the circumstances. Clearly, the age of the forest and the proportion of damaged trees were important factors when considering the forest owners' options. In very severe cases, the timber buyers' advice would likely be to cut down everything and establish a new forest. For example, a timber buyer referred to the tenth paragraph curve of the Swedish forestry act, which specifies how much volume must remain in the forest after thinning. In other words, if a lot of trees are damaged, there is a risk that the stand will be too sparse if only the damaged trees are removed.

When the proportion of damaged trees is low to medium, the timber buyers suggested that as much of the damaged trees as possible should be removed by thinning. However, it also emerged that the advice partly depended on the type of forest owner involved and what their needs were. It was easier for the timber buyers to give this advice to active forest owners who could go out into the forest and do the work themselves. That is, they cut down the damaged trees manually with a chainsaw and then sell the timber by the roadside. Because the forest owner needs to weigh the cost of carrying out the work against the cost of not removing the damaged trees. Moreover, as one timber buyer pointed out, the removed trees may

have already infected adjacent trees. Concerning pine stem rust, the respondent therefore concluded that “it is hard to give really good advice”.

3.3.3 Moose grazing damage

Moose grazing damage mainly occurs in young pine forests and the advice for how affected forest owners should act varies in a similar way as for pine stem rust. That is, an overall assessment is often made of how viable the forest is, what and how much must be cleared or, in the case of serious damage, if one has to start from scratch. If the latter is the case, one timber buyer said that “if it is possible in view of the land, we usually advise to change the type of tree”. However, most of the timber buyers’ advice and actions linked to moose grazing damage were of a preventive nature and are therefore presented in the following sections.

3.4 Timber buyers’ advice to prevent damage

3.4.1 The rejuvenation phase

There was a general opinion among timber buyers that the rejuvenation phase is when the forest owners have the most opportunities to influence the future state of the forest. Furthermore, it is during this phase that the foundation for a healthy and vital forest can be shaped. Thus, many timber buyers emphasized the importance of planting the right type of tree based on the type of soil and growth conditions on the site. A word for this that came up in several interview was "ståndortsanpassning" (i.e. adaptation to the location). Several of the interviewees expressed that this had become more noticeable in recent years and it was also clear that it had not always been like that. For example, one respondent explained that “too much spruce has been planted on the wrong soils”, leading to a situation with “less and less food for the moose and forests that does not grow”.

By following the practice of planting the right trees on the right land, the proportion of pine and spruce that is planted on a rejuvenation area can vary. However, it is rare that they mix and plant every other spruce and every other pine, it is either or. This can mean, for example, that the timber buyers recommend pine for high elevations and spruce for low elevations. In addition, conditions are created for more species to come in through self-rejuvenation of, among other things, birch. Furthermore, in areas at high risk of moose grazing damage, some timber buyers often recommended forest owners to rejuvenate the forest by solely using self-rejuvenation methods because planting seedlings followed by early pre-commercial thinning was not considered successful.

The timber buyers also described that today there is a greater focus on mixed forests, and that this is taken into account right from the start. However, although

this sounds good in theory, one timber buyer pointed out that they are sometimes quite limited in the advice they can give regarding what tree species to choose. Because even though the risk of damage may be high for that particular type of tree, the soil may not be suitable for anything else. The respondent summed up the situation by saying that "it is quite wrong to plant a spruce tree here and most people avoid lodgepole pine, so you are often referred to plant pine again, even if you don't really want to do it".

A respondent in the south said that after 2017 it has become more common to carry out soil scarification in order to improve the conditions for self-rejuvenation. In this way, you get a larger selection of trees and it is easier to create a mixed forest with the right tree species in the right place. Another reason for this is to prevent the pine weevil (*Hylobius abietis*) from causing damage on the seedlings, which has become a greater concern after the use of chemicals as protection against the insect stopped. Furthermore, in recent times, to an increasingly greater extent, this company in the south had switched to a different type of seedling than before. Nowadays, they increasingly offer seedlings that have their roots covered by soil (in Swedish called täckrotsplanta) as they have a stronger root and higher resistance to pests. Another mentioned advantage of this type of seedling was that it is more difficult to make mistakes when planting, which is a factor they also need to consider since it is difficult to get hold of experienced planters.

In the south, there had also been campaigns to increase the proportion of pine trees. However, according to one timber buyer, the success in this had been varied. The respondent expressed that it had been somewhat easier to convince younger and newer forest owners to select pine compared to older forest owners who had experienced that the pine forest was often damaged. In the north, where the forests are often dominated by pine, it was sometimes the other way around as some timber buyers said that they now recommended spruce to a greater extent than they had done before.

Use of alternative tree species

Several timber buyers from north to south said in the interviews that there is a growing interest among forest owners to plant larch trees when rejuvenating their forests. However, it is increasing from a low level and according to a timber buyer working in central Sweden it was around 5–8% of forest owners who had currently chosen to plant larch. The amount of larch trees planted was also very different between the cases. In some cases, only a few hundred seedlings were planted, but according to some timber buyers, there were also those forest owners who had chosen to establish entire stands of larch trees.

Several reasons for the growing interest could be identified from the interviews. One reason was that there is a curiosity among forest owners and a desire to experiment with something new. Another was that the type of tree is perceived as

appealing both aesthetically and production-wise. As state by one of the timber buyers, “everyone thinks it is a nice tree species, and it grows so incredibly”. A third reason was that forest owners perceive larches as a good alternative to lower the risk of forest damage, which was particularly evident in areas with high occurrence of pine stem rust. Furthermore, forest owners who are afraid of suffering forest damage from moose grazing can consider it as a viable alternative. However, some timber buyers also expressed that forest owners sometimes have a misconception about the excellence of larches. According to one timber buyer, “they believe that the larch trees are like the salvation of everything”. This is not the case, as it appeared in the interviews that the larch trees are also affected by grazing damage. Whether it was from moose or other ungulates such as deer was unclear, however, according to one of the timber buyers who brought this up.

There was a mixed attitude to the larch among the timber buyers. Some of them said that there was a local demand for this wood and that it will probably increase as the raw material supply increases. One of the participating companies also bought and sawed larch at its own sawmills. On the other hand, some timber buyers raised potential problems for the pulp industry in using larch, because the tree's properties are different compared to pine and spruce. A majority of timber buyers emphasized that planting larch it is not something they actively recommend, because primarily they usually recommend pine, spruce or birch, depending on the soil type. Nevertheless, if the forest owner requests it, they try to provide it. One piece of advice given by a timber buyer to forest owners considering this option was not to plant too few larch trees: “I usually say that it is better to plant 5000 larch trees than to plant 500 larch trees, because you have about the same amount of damage on them”.

In addition to the fact that larch trees are not actively recommended by the companies, the timber buyers stated two other reasons why they believe that the increase in larch trees will not be large in the near future. One is that forest owners who want to have their forest certified currently cannot have more than five percent of foreign tree species in their forest. Another factor is that the supply of seedlings is limited and at the time of the interviews, demand was said to be higher than supply.

The timber buyers were also asked if they advise forest owners to plant lodgepole pine (*Pinus contorta*) in order to reduce the risk of forest damages. In general, they said that the interest for this is low and according one respondent from a company that has forests consisting of lodgepole pine, it appears that the lodgepole pine is about to be phased out. The same respondent said that lodgepole pine is not something they actively recommend to forest owners. However, there were also a couple of timber buyers who said that it is an option that they can mention to forest owners, but that few are interested. One said that “it is perhaps one in a hundred who wants to plant lodgepole pine”. The advantages of lodgepole

pine, according to the timber buyers, were that it grows well as long as it is planted in suitable places and that it is a fairly safe choice as it has good survival. Nevertheless, they said at the same time that there are many bad examples and mismanaged forests that have strongly influenced the forest owners' perception of the lodgepole pine.

Rest period between harvesting and rejuvenation

There were partly different opinions and practices between the respondents and companies when it came to whether a clear-cut area should be allowed to rest for a period before rejuvenation through planting is done. Some recommended that planting be done as quickly as possible, but a majority recommended a rest period of one or two years between felling and planting. This difference was to some extent geographical. Most timber buyers who recommended a rest period after felling worked further north compared to those who considered it good to get the seedlings into the ground as quickly as possible after felling. Recommendations could also vary depending on the fertility of the land, where the timber buyers usually did not recommend rest periods on fertile land because it can lead to competition problems with other fast growing vegetation. It also became evident in the interviews that the timber buyers may need to persuade the forest owners not to be in too much of a hurry with the rejuvenation. For example, one of the timber buyers said that:

> It will be so much worse, both soil scarification and planting, if you are in too much of a hurry. Therefore, you have to explain it in almost every single place you go and harvest, and almost everyone accepts it when they learn the background.

In addition to the fact that rest periods were not recommended due to the above-mentioned circumstances, there was also an economic incentive for timber buyers to get the plants in the ground as quickly as possible. Partly because the new forest gets started faster, but also because the forest owners are then ready for new timber deals. As one of the respondent explained:

> The timber buyers are really into it, that you harvest, take out the biomass, and do soil scarification and plant. When you are done with that, then the forest owner is ready to think about a new felling. You have to complete a project in order to get new contracts. The forest owner is somehow not there mentally if they have not finished the first project.

3.4.2 The growth phase

Some time after the rejuvenation phase comes a time when the young forest can suffer from, for example, moose grazing damage. It is also during this period that the forest owner can influence the future nature of the forest through (pre-commercial) thinning. During this phase, the timber buyers main function is to advise the forest owners on when different measures should be carried out, and how they can be carried out to get the desired result. During the interviews, some timber

buyers emphasized that it is important that the measures are not taken too early, but not too late either, as this increases the risk of damage. One of them summarized the timber buyers' role like this:

> And when you reach the age of thinning, then it is to advise them to really do the thinning, not to wait and wait and wait but do the thinning. Remove all damaged trees in good time to keep the frequency (of damage) down. It becomes a bit of our task because it generates wood, we are timber buyers, so it involves buying wood. But you do a good job at the same time, and they understand that even though it doesn't generate a lot of money.

It can thus be noted that the timber buyers also have a financial incentive for the forest owners to be active and carry out thinnings or final-fellings. When asked if the forest owners often listen to the timber buyers' advice, the timber buyers in general felt that they often had a significant influence on the forest owners' decisions. The degree of influence was partly related to the forest owner's own level of knowledge and interest in forestry.

A general piece of advice to forest owners during this period was also to be out in the forest often to be able to identify damage. In normal cases, it is the forest owners themselves who identifies damage and contacts the timber buyer for advice and help. As mentioned earlier, some companies also offered digital channels to report damage. It emerged from the interviews that the timber buyers rarely go out on their own initiative and check if the forest owner's land is affected by damage. However, they can go out and check if the forest owner contacts them and requests that service.

Continuous cover forestry

Several timber buyers expressed that the interest in continuous cover forestry has increased but that there are still few forest owners who apply it. One of them estimated that 2–3% of forest owners had tried it. It was also not something that the timber buyers actively advise on, and the initiative to this type of forest management must therefore come from the forest owner. However, they emphasized that they should have knowledge about it so that they can advise if necessary. Some admitted, however, that knowledge of this within the companies is still low and that there are uncertainties about e.g. profitability. In some companies, however, internal training efforts have been carried out recently to prepare the timber buyers for the questions that may come from the forest owners about this. Another obstacle to more actively offer this type of service on a larger scale was said to be the lack of forestry contractors with the right qualifications.

Increase the share of deciduous trees

Saving deciduous trees when thinning was something that many timber buyers recommended to forest owners. This advice is linked to the fact that the forest

certification rules require that a certain percentage of deciduous trees must remain after thinning. Moreover, respondents described how the attitude towards deciduous trees has changed over the years. Today, it is recognized that having a mix of deciduous trees in coniferous forests makes them more vital and resistant to pests and a timber buyer said that “we realize that deciduous trees must be given a more prominent place in the forest”. The same timber buyer had also experienced an increasing demand for this assortment from the industries, which means that it is also financially justifiable to invest in a higher percentage of deciduous trees. However, the timber buyers may still be questioned about this because some elder forest owners still have the idea that deciduous trees are something bad and should be removed. One timber buyer argued that “you actually have to actively tell forest owners that in modern forestry you should absolutely not remove deciduous trees, but rather the opposite, we should have more deciduous trees”.

3.5 Advice and information via magazines

3.5.1 Frequency of articles about forest damage

Magazines published by three FOAs and three large forest companies were examined to see how frequently and to what extent the forest owners were informed about forest damage through this channel. As shown in Table 2, the magazines with the smallest proportion of articles on this topic during the examined period were Norra magasinet (Norra skog), Din Skog (SCA) and Skogsnära (StoraEnso). In these, an average of four to five percent of the articles and news were judged to deal with forest damage in one way or another. However, there was considerable variation between the issues, as some had no articles at all while others had more than 10%. This was also the case for the other journals. The magazine with the highest percentage of articles dealing with forest damage was Skogsliv (Holmen), which, unlike the others, was only issued twice a year. One reason why this magazine ranked high was that in the first half 2024 it had a special issue on climate adaptation. In second and third place, based on the proportion of articles on forest damage, came Södrakontakt (Södra) and Med Mellanskog (Mellanskog), both published by forest owner associations. Of these, Södrakontakt was the most consistent as it had no issues with zero articles dealing with forest damage. On the other hand, Med Mellanskog had a relatively high proportion (>10%) of articles on the theme in six of ten examined issues.

Table 2. Percentage of articles in each issue that focused on forest damage or how to manage the forest to avoid them in the future, e.g. through climate adaptation. Skogsliv was only issued twice a year, while two issues of Skogsnära were not available online.

No./Year	Södrakontakt	Norra magasinet	Skogsliv	Din skog	Skogsnära	Med Mellanskog
2/2024	2.8	4.1	N/A	0.0	0.0	12.5
1/2024	2.8	0.0	31.3	13.6	0.0	0.0
4/2023	11.4	4.3	N/A	0.0	0.0	5.0
3/2023	5.7	12.0	N/A	9.1	6.3	21.0
2/2023	11.1	7.4	6.3	4.0	5.6	21.0
1/2023	4.3	0.0	0.0	7.7	11.8	5.3
4/2022	9.7	0.0	N/A	0.0	N/A	17.6
3/2022	9.1	4.2	N/A	3.6	0.0	12.5
2/2022	18.2	3.8	15.0	0.0	N/A	12.5
1/2022	13.2	11.5	14.3	4.0	5.0	5.6
Total	**8.8**	**4.9**	**13.4**	**4.2**	**3.7**	**11.3**

3.5.2 Type of content

Södrakontakt

Of the 28 articles and news items found in Södrakontakt, twelve (43%) focused on forest damage caused by bark beetle. Some were only short updates on the amount

of damage during the last year, but there were also full-length articles. For example, one article covered how damages were investigated by using drones and one article reminded the forest owners that it was time to go out in the forest and look for damage. Another recurring theme was moose damage, which was covered in eleven articles (39%). Here, too, there was a mix of basic information on damage levels and articles highlighting new inventory methods or people working on the issue. The remaining five articles partly dealt with the climate issue, but also highlighted deciduous trees as a possible solution for the future with regard to biological diversity and a good supply of wood.

Norra magasinet

Twelve articles and news items linked to forest damage had been published in Norra magasinet. Of these, four were about moose grazing damage, three were focused on wildfires, two were focused on storm damage, another two were focused on bark beetles and the last one dealt with climate change. However, it should be mentioned that both publications on bark beetles were only brief notices. Also worth noting is that one of the articles was based on a question submitted by a forest owner who wanted to know how to manage a storm-damaged forest.

Skogsliv

This magazine always had a specific theme for each issue. During the examined period the themes were “climate adaptation”, “generational changes”, “remote forest owners”, “spruce” and “deciduous trees”. As can be seen from Table 2, several of these had a strong connection to forest damage. Some of the topics covered were the importance of tree species selection based on the suitability of the land, how to identify bark beetle damage, and the benefits that deciduous trees can bring to both animals and humans.

Din skog

Ten articles connected to forest damage had been published in Din Skog and the topics covered six different types of damage. It is noteworthy that about half of these articles contained concrete tips for the forest owners, to varying extents. Articles on insect damage were among the most common because two articles were about pine weevils and one was about bark beetles. Furthermore, one article informed the readers about ongoing research regarding management and prevention of pine stem rust. Other types of damages covered were snow breaks (i.e. the top of the tree comes off due to the weight of the snow) and rot. Finally, two articles of a more general nature but still connected to the subject were the ones that covered continuous cover forestry.

Skogsnära

Two of the five articles found in this magazine covered forest damage caused by bark beetle. One of them was merely a short update on the current damage situation, while the other one informed the forest owners that it was time to go out in the forest and look for damaged trees. This because it was the time of year when forest owners have the greatest chance of reducing the number of bark beetles. Another topic covered in one article was the importance of selecting the right tree species when rejuvenating the forest after a harvest. Related to this, another article described how the Swedish Forestry Agency urges forest owners to choose pine when the soil type is suitable for this, and that cooperation between hunters and landowners can counteract grazing damage in these stands. Finally, one article was about StoraEnso learning more about continuous cover forestry in order to be able to give better advice on this to interested forest owners.

Med Mellanskog

Of the 19 articles found in Med Mellanskog, eight (42%) were about bark beetles. Most of these were short updates on the amount of damage it had made during the previous year or half-year, but in one case, the forest owners also received concrete advice on what to do in order to reduce the risk of getting damage. Furthermore, another article covered how the association's staff can help forest owners by using new technology for inventory but it also contained some information about the solutions to the problem. For example, more deciduous trees and shorter rotation periods. In addition, in a related article a forest owner whose forest had been damaged by bark beetles was interviewed about how he had dealt with the problem. Two other topics that were covered in several articles were climate adaptation and continuous cover forestry. Finally, a couple of articles provided information about how to prevent wildfires.

4. Discussion

This study investigated what advice and services forest companies in Sweden currently provide to forest owners regarding forest damage, which is currently a major problem in many parts of the country (Swedish Forest Agency 2024a). Knowing what advice is given to the forest owners is valuable because it gives a better picture of what efforts are being made today to counteract the occurrence of new damage and manage the existing ones. This also increases the understanding of what is missing and needs to be developed in counseling for different groups of forest owners. Because as we know from previous studies, timber buyers' advice is important to many forest owners and has a great influence on their decisions (Hujala et al. 2007; Hujala et al. 2009). Also in this study, the timber buyers perceived that the forest owners often follow their suggestions. Timber buyers and other professional foresters can thus play an important role in reducing the level of damage both in the short and long term.

With regard to the basic range of services, the results showed that forest owners could receive approximately the same service from all forest companies and forest owner associations. This included all types of forestry services as well as advice in various areas. This was an expected result since having a diversified range of services and being able to act as a one stop shop for forest owners has been an explicit strategy for many service providers (Kronholm 2016; Andersson & Keskitalo 2019). Furthermore, the results also clearly show that the advice and services that timber buyers provide are primarily focused on ensuring that the forest is doing well from a timber production perspective. Thus, the orientation of the services offered on the Swedish forestry market are very similar to neighboring Finland, where the focus has also traditionally been on serving forest owners who primarily focus on timber production (Mattila et al. 2013). From a timber buyers perspective this is natural because their job is to ensure that the company's raw material needs are met now and in the future. Moreover, that the timber buyers have this attitude is in line with previous studies on how they perceive the importance of various forest functions and it does not seem to have changed significantly over time (Kindstrand et al. 2008). The timber buyers' views are therefore slightly different from the forest owners in general because these often have several other goals that are prioritized as high or even higher than income from timber production (Lidestav & Westin 2023). This is thus something timber buyers need to be aware

of and take into account when giving advice, because the risk of having dissatisfied forest owners increases if they are not perceived to take the forest owners interest into account (Kronholm & Staal Wästerlund 2021). However, forest owners should also take into account that the timber buyers may have personal gain from certain advice they give.

When it comes to the handling of forest damage that has occurred, the results show no major differences between the timber buyers' advice depending on which company they represented. The advice and services related to this were largely about how to get rid of the damaged trees or the damaged forest in the best way, if felling was deemed necessary and appropriate. However, this assessment was often situation-dependent, which made it difficult for the respondents to give clear answers about how they act in each specific situation. Here both the forest owner's personal goals and characteristics as well as the nature of the forest influenced the advice and decisions. As shown, the timber buyer's toolbox is larger when the forest owner is more experienced and proficient in forestry. On a general level, this may mean that male forest owners with larger properties and who have owned their forest for a long time may be an easier target group for timber buyers because they often perceive themselves to have more knowledge about forests than other groups (Eriksson & Fries 2020). Thus, ongoing changes among the forest owners can also affect the type of advice the timber buyers may be able to give in the future. Given that self-employment has decreased over time and new forest owners may often have limited insights into practical forestry in general and handling of forest damage in particular (Kronholm 2024), this may mean increased opportunities to sell more services (Andersson & Keskitalo 2019). On the other hand, it can become a concern from a pest control point of view if forest owners who do not have the knowledge or opportunity to cut down the trees themselves would rather let the damaged trees remain than pay for someone else to do the job. Provided that the law does not require them to be removed. Because often the forest owner's own work is linked to keeping costs down for mandatory measures (Lidestav & Westin 2023). Furthermore, there are also risks associated with a growing knowledge gap between timber buyers and forest owners, for example that it leads to wrong expectations and more misunderstandings (Andersson & Keskitalo 2019).

The results showed that much of the timber buyers' advice on preventive measures is linked to the rejuvenation phase. That this is the case may partly be due to the fact that it is in connection with felling measures that the timber buyers often advise the forest owners. However, as the timber buyers emphasized, it is also then that the forest owners have the greatest opportunity to influence the character of the future forest. Regarding the advice given by the timber buyers, they are largely in line with the advice given by the Swedish Forest Agency (2024a). The emerging trend is that there is currently a strong focus on creating mixed stands and that site adaptation is highlighted as an important factor in creating healthy forests.

A more general advice to forest owners was to regularly visit the forest in order to keep track on potential damages or risk elements. This is also something that is done by a large part of the forest owners, but far from all do it (Kronholm 2024). Increased urbanization among forest owners can also make it more difficult for more people to follow this advice because the distances to the forest increase when an increasing proportion of forest owners live in one place and have the forest in another location (Swedish Forest Agency 2024b). Already today, almost a third feel that they have a long or very long way to their forest (Triplat et al. 2023). This will also affect their ability to follow the timber buyers' advice to be active in their management of the forest. Finally, the timber buyers' advice to carry out forest management measures at the right time may also seem easy but in practice may be difficult for some groups. Perhaps especially for the relatively large group of forest owners who lack a forest management plan that points out when various measures should be taken. Increasing the proportion that has a plan is important because it has been shown to have a positive effect on forest owners' active damage control (Molnar et al. 2007).

Looking at different management alternatives, the timber buyers had experienced an increasing interest among forest owners to try continuous cover forestry instead of practicing rotation forestry. This is in line with previous studies in both Sweden and neighboring countries with similar ownership structures and forestry practices (Juutinen et al. 2020; Kronholm 2024). However, the results also show that the timber buyers' and their employers in general have a cautious approach to alternative forestry methods such as continuous cover forestry. This was not surprising since previous studies have identified traditions, norms and expectations around profitability as obstacles to increased use of the method (Dehlin et al. 2023). From their perspective it is thus foremost an alternative method that can contribute to other types of goals than just timber production (Lygner & Edholm 2024). That the industry does not want to rush into this forestry practice is to some extent understandable because even if continuous cover forestry can offer several benefits in comparison to rotation forestry, the growth is lower and less biomass can thus be harvested (Peura et al. 2018; Bianchi et al. 2020). The development of new service in this area forward will thus likely be a bottom-up process where the interest of the forest owners largely drives what services the companies will offer. An example of this is that in September 2024, the forest owner association Södra announced that they have introduced a specific service for those members who want to try continuous cover forestry on a small scale (Södra 2024). Also other companies have expressed that they may consider to do so (Casson 2023;). As the results show, the companies have also invested in training for those who will act as advisors to the forest owners, which the interviewed timber buyers also perceived to be necessary. This has also been communicated to the forest owners via their own magazines (Fries 2023), which shows that it is something that

is considered important to be able to meet the requirements of modern forest owners. Furthermore, also from the legislative side there may be new requirements in the area within the next few years that affect companies' advice regarding continuous cover forestry since authorities have recently expressed a need for more government control in this direction (Dehlin et al. 2023).

Another thing the forest companies will more often have to advise the forest owners about is the use of alternative tree species. However, as emerged in the study the use of foreign tree species will probably remain a minor supplement to domestic tree species for the foreseeable future. For a greater spread in use, it would be required both that the supply of seedlings increases and that restrictions in the certification rules would be removed. The first could probably be satisfied by the market in the long run if the demand remains, but the latter may be more difficult to achieve because there are conflicting interests around the use of exotic tree species. Because previous studies show that those who assign greater importance to environmental values are often against a greater use of novel tree species, while those who emphasize economic values are more positive about this (Lindkvist et al. 2012).

4.1 Study limitations

This study is primarily based on qualitative data collected through interviews with a selection of timber buyers. The goal of the selection process was to find interviewees from different types of forest companies in different geographies. This in order to shed light on a diversity of problems and factors that influence timber buyers' advice to forest owners with a relatively small sample. This goal was achieved fairly well, but it should still be pointed out that the study does not give a complete picture of all the advice and services to forest owners that occurs in Sweden today. For this, further studies of a more quantitative nature are needed. As always in this type of study, there may also be a certain selection bias in which timber buyers participated. This is because the selection of interviewees was largely determined by which persons voluntarily wanted to participate in the interviews. The assessment is, however, that the results would not have been significantly different if other timber buyers had participated because the Swedish forestry sector is rather homogeneous in terms of forestry practices. Especially when it comes to larger forestry companies, which was the sample group for this study. The respondents' knowledge that their identity would not be revealed should also have reduced the risk of them answering based on what they think their employer wants them to say rather than what they actually do in their daily work. However, it cannot be ruled out that things that could be perceived as negative have not been mentioned or that the respondents have emphasized some positive things.

5. Conclusions

The study highlights that one of the timber buyers' most important and influential parts in forest damage prevention is the advice they give to the forest owners in connection with the forest regeneration phase. In later phases, when damage has already occurred, the remedial options they can suggest are often limited. Furthermore, it is clear that the forest companies' services will mainly benefit the active forest owners because the timber buyers usually do not actively contact forest owners to advise on forest damage. Moreover, their primary focus is on timber production and timber procurement. Advice and support for other groups of forest owners therefore need to be organized in a different way through organizations that work more with outreach activities. Finally, the study also shows that the forest owners' interest and curiosity can drive development in terms of the implementation of new forestry methods and new tree species in the Swedish forest.

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